



Multipacting Phenomena simulations for the Crab cavity

Valentin Ivanov

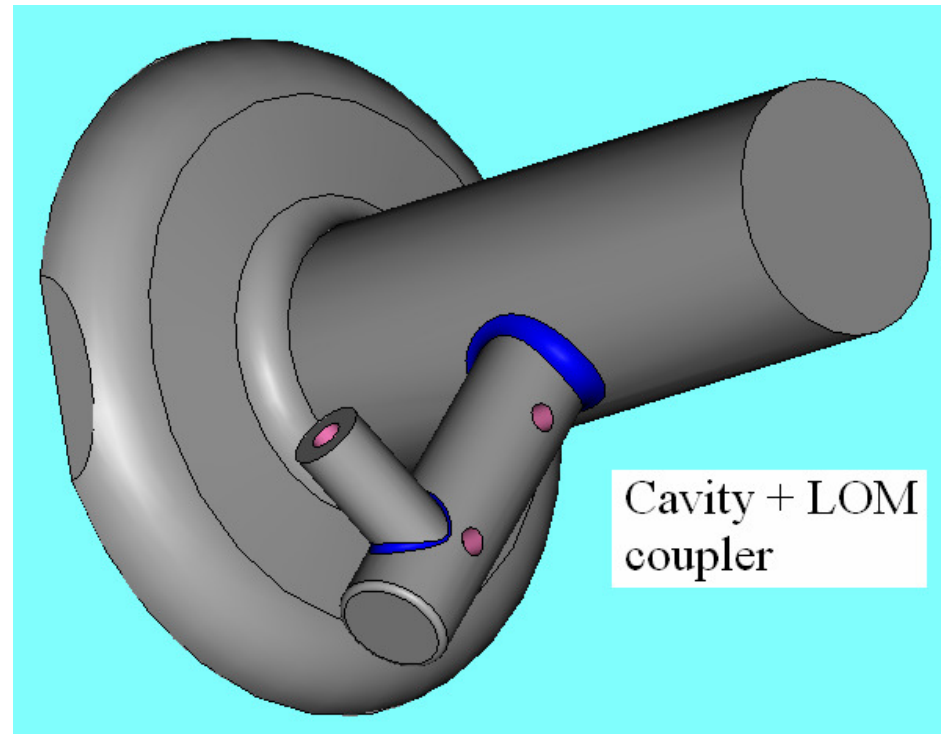
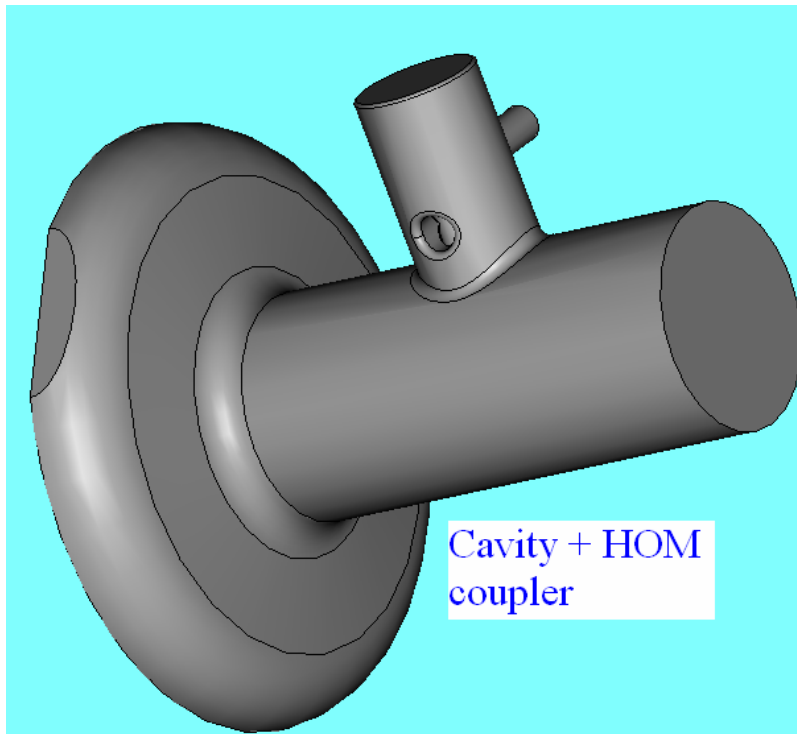
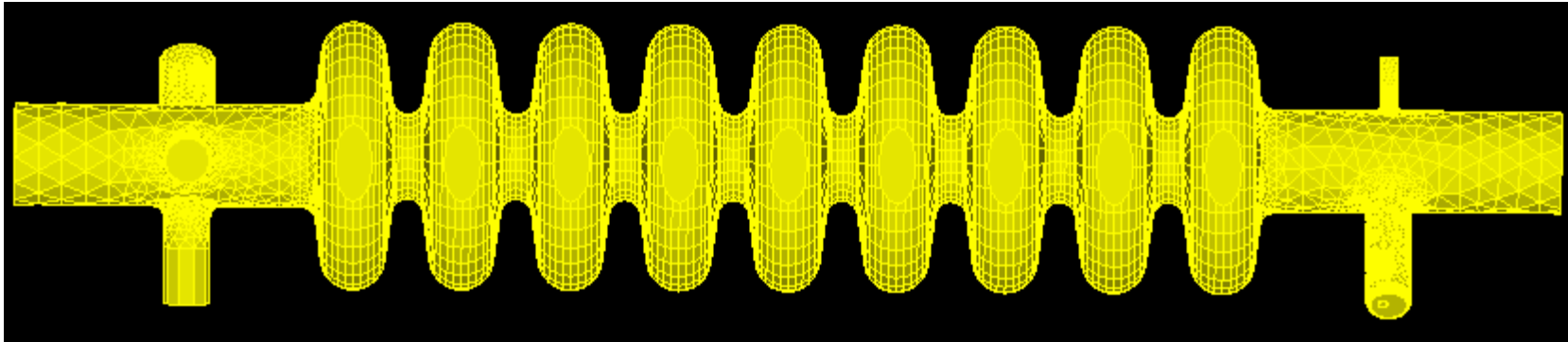
FNAL

8 March 2007

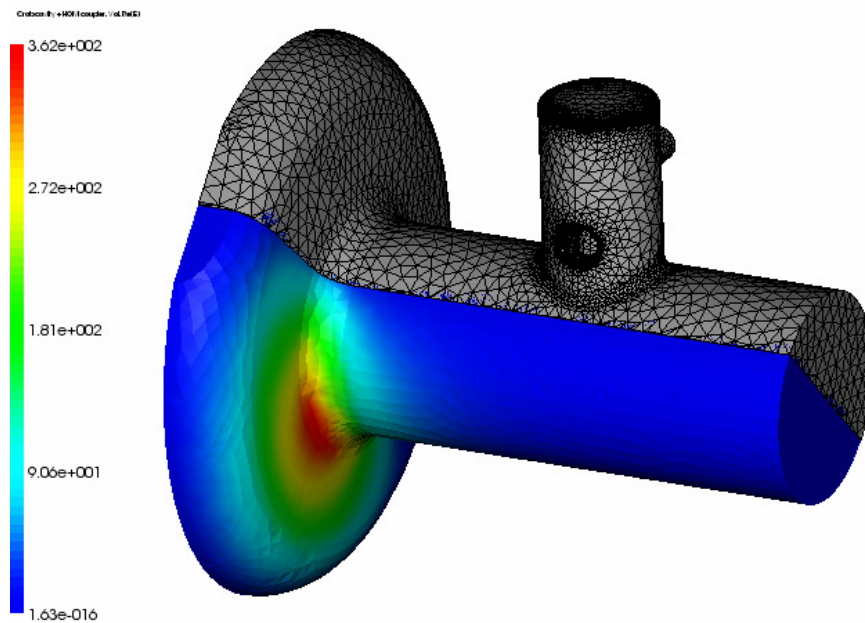
Outline

- 9-cell Crab cavity with couplers
- MP study in 1-post HOM coupler
- MP study in 2-post HOM coupler
- MP in LOM coupler (FNAL design)
- Acknowledgments
- Summary

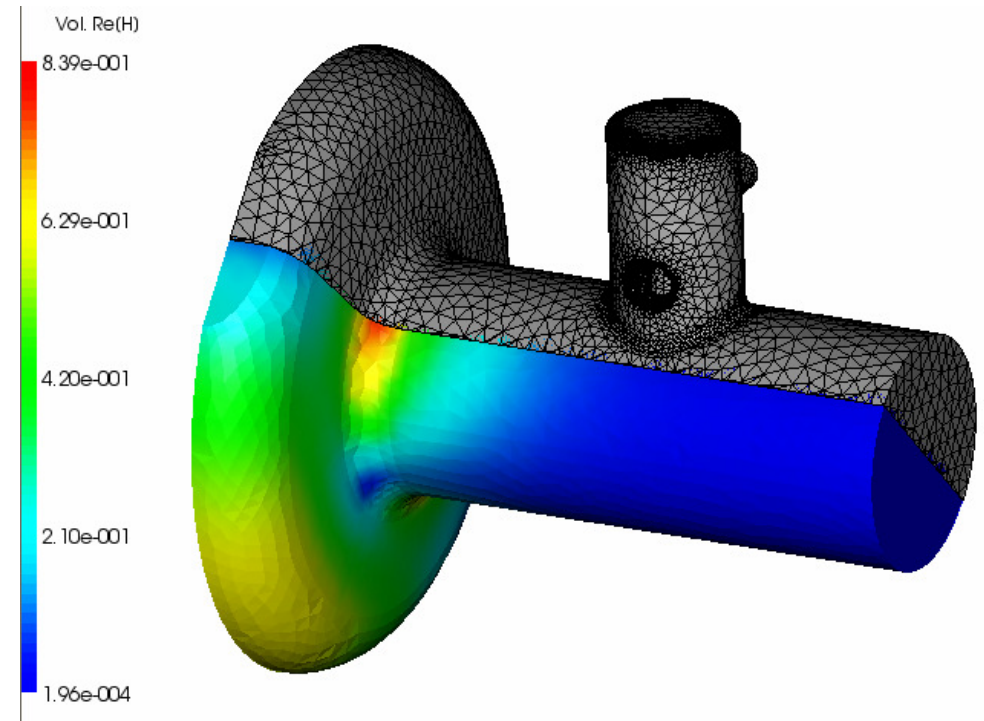
9-cell Cavity



MP Study in 1-post HOM Coupler



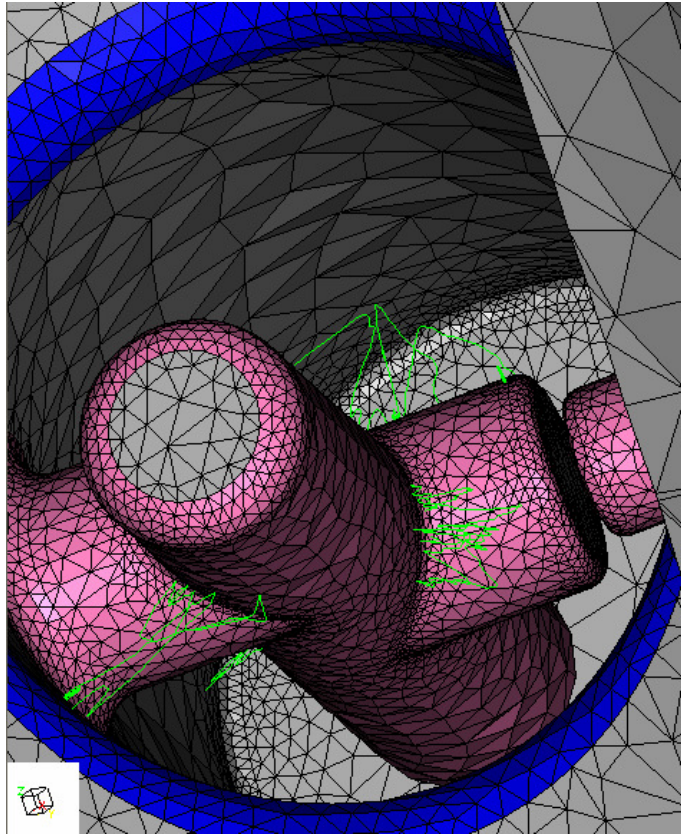
Electric field



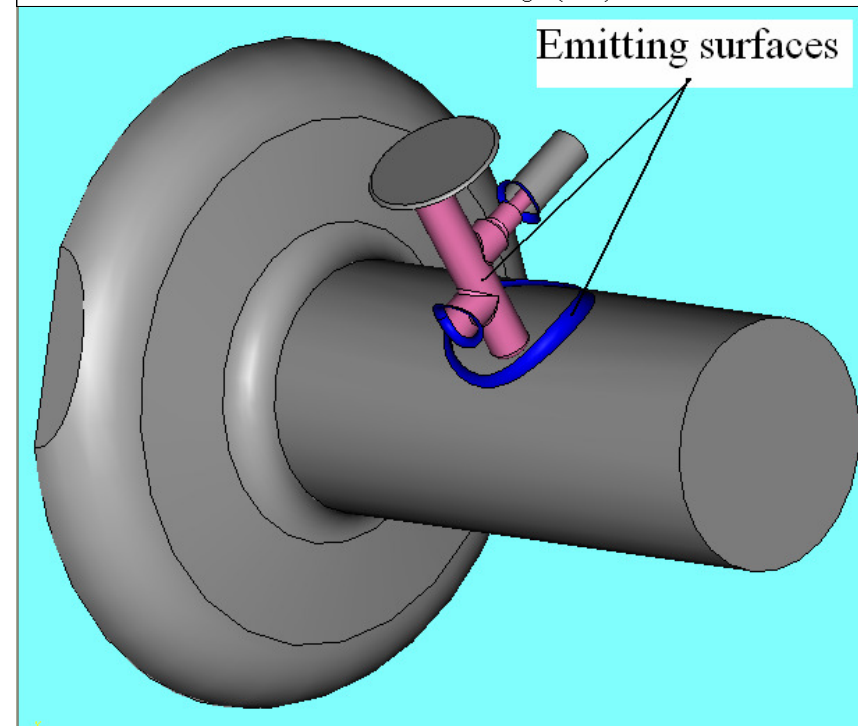
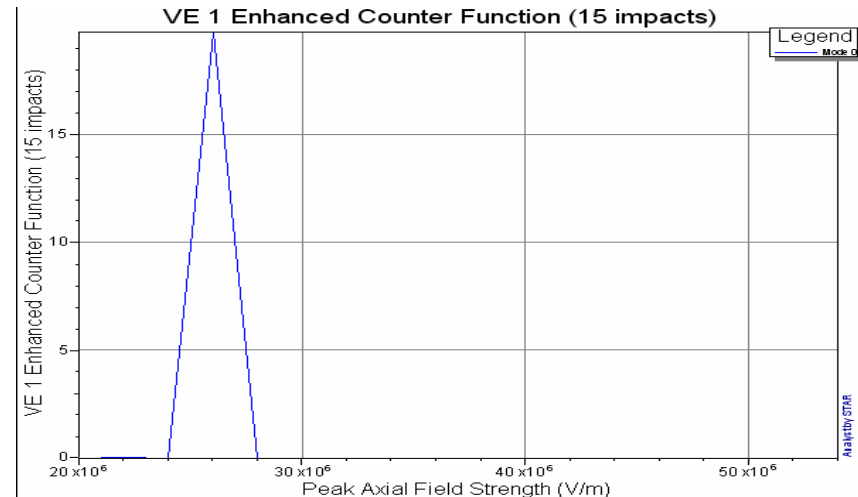
Magnetic field

Tetrahedral mesh ~33,000 nodes; 200,000 DOF.

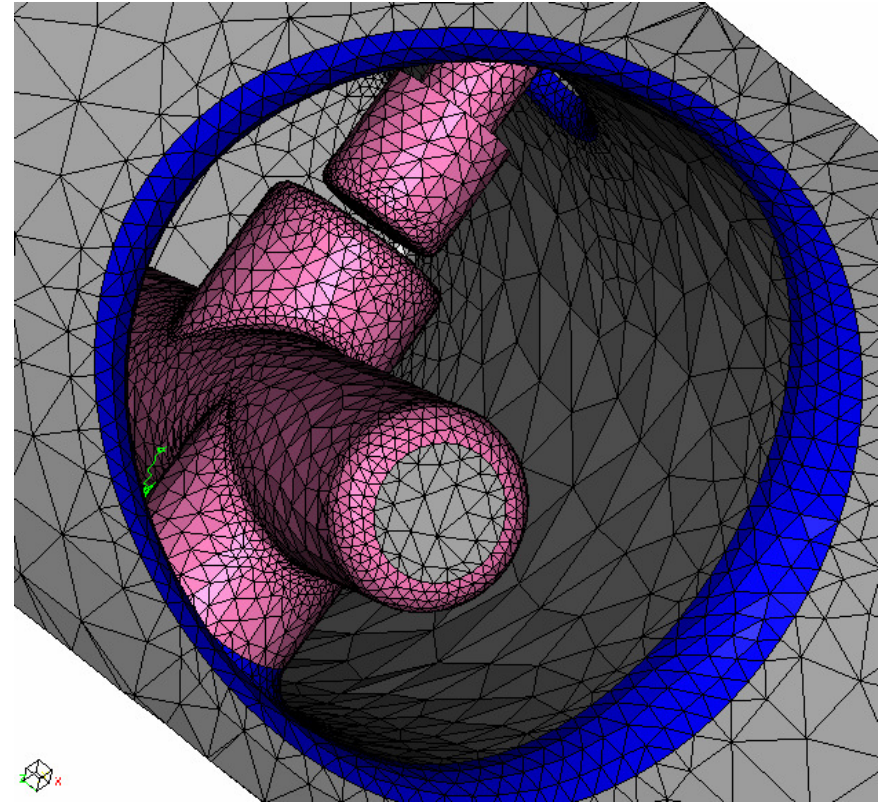
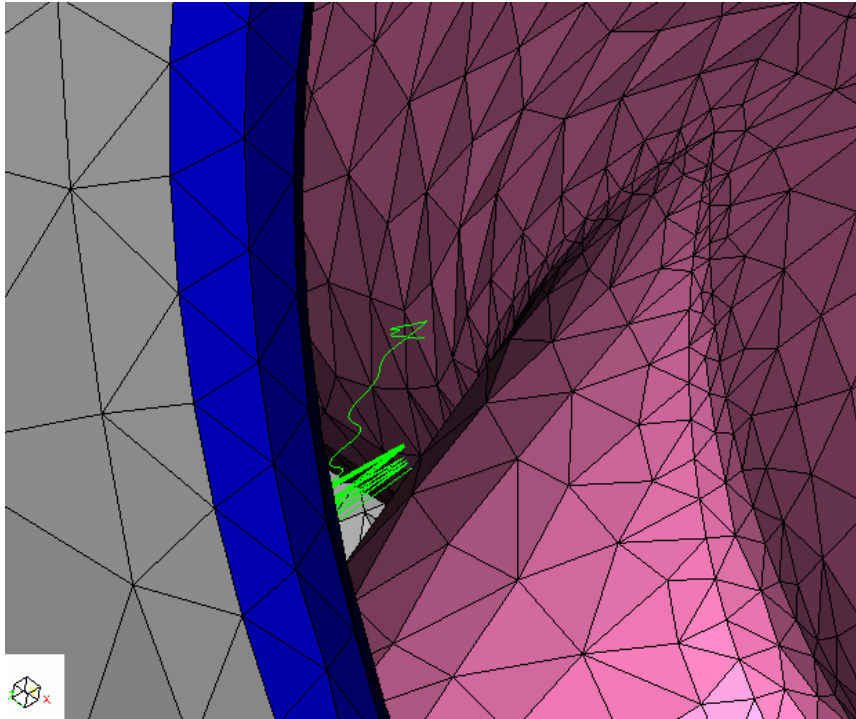
MP Phenomena in HOM Coupler



MP is founded at the field level 26 MV/m.
The field is normalized for maximal
electric field (E_x) on the axis

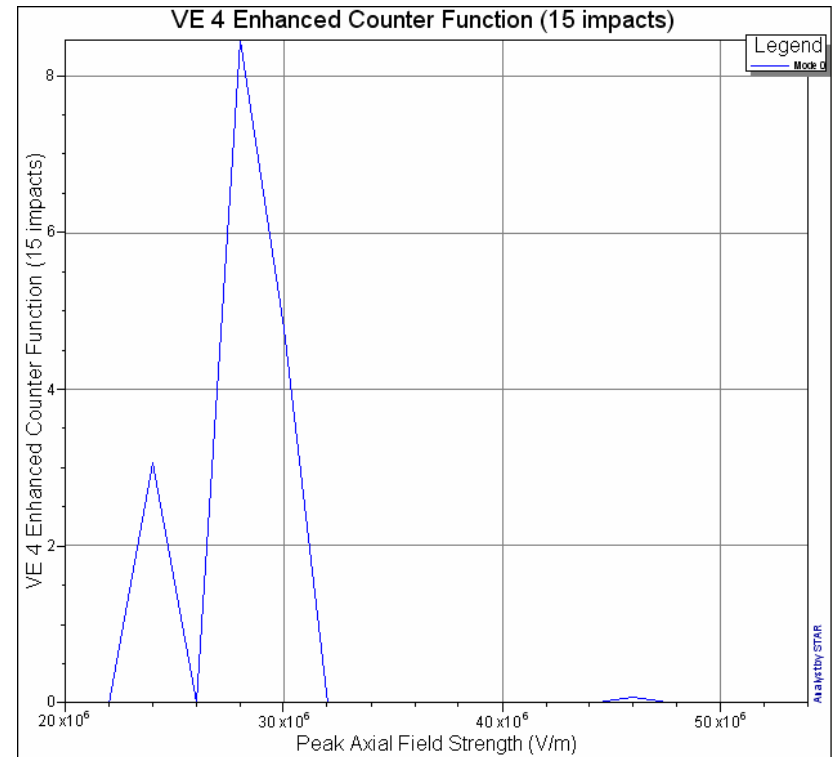
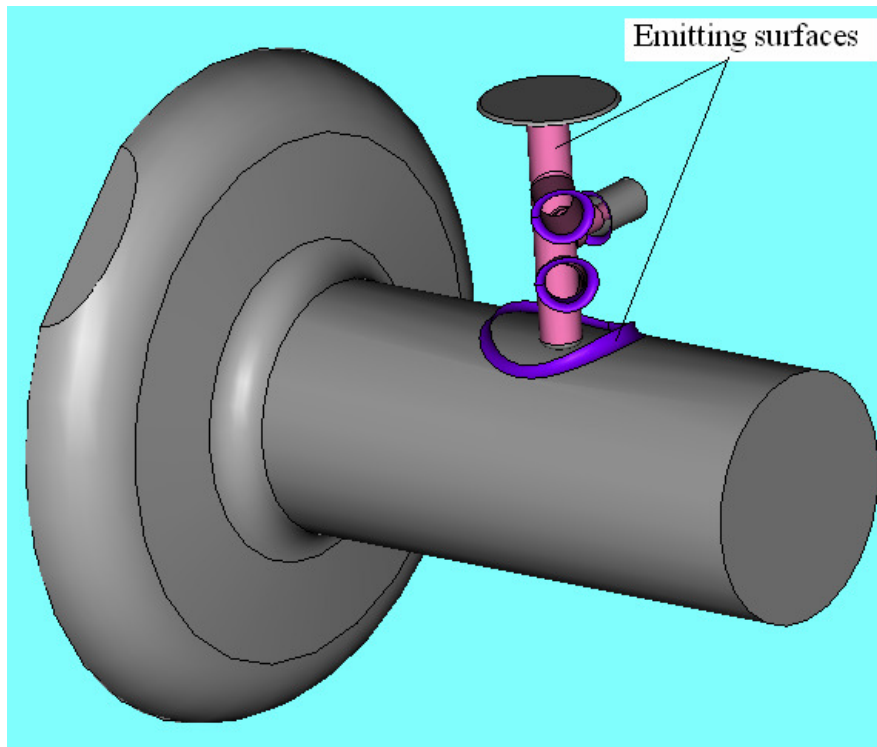


MP Phenomena in HOM Coupler



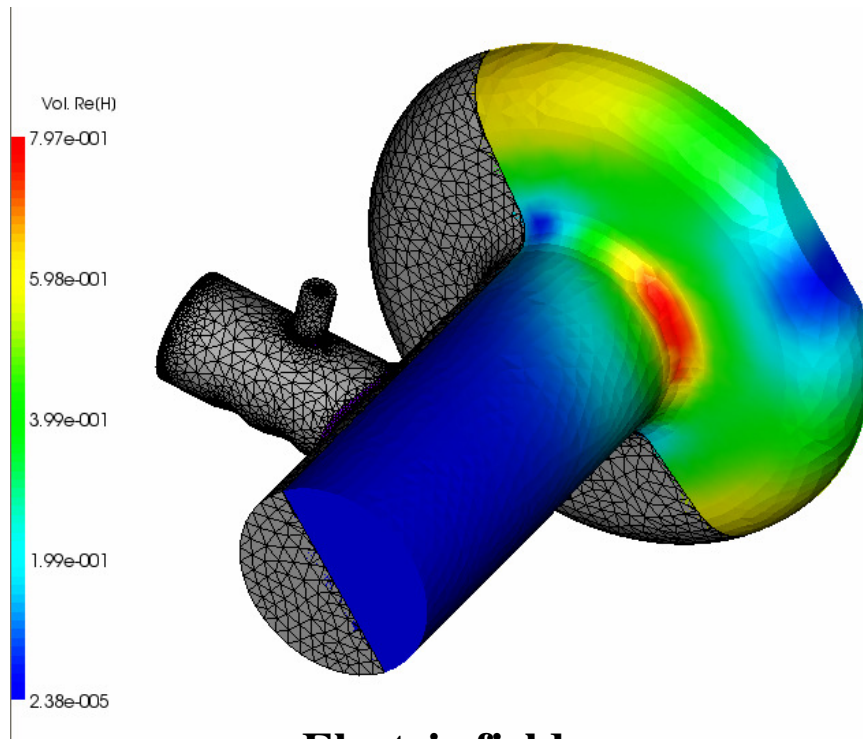
- MP at the field level 26 MV/m

MP Study in 2-post HOM Coupler

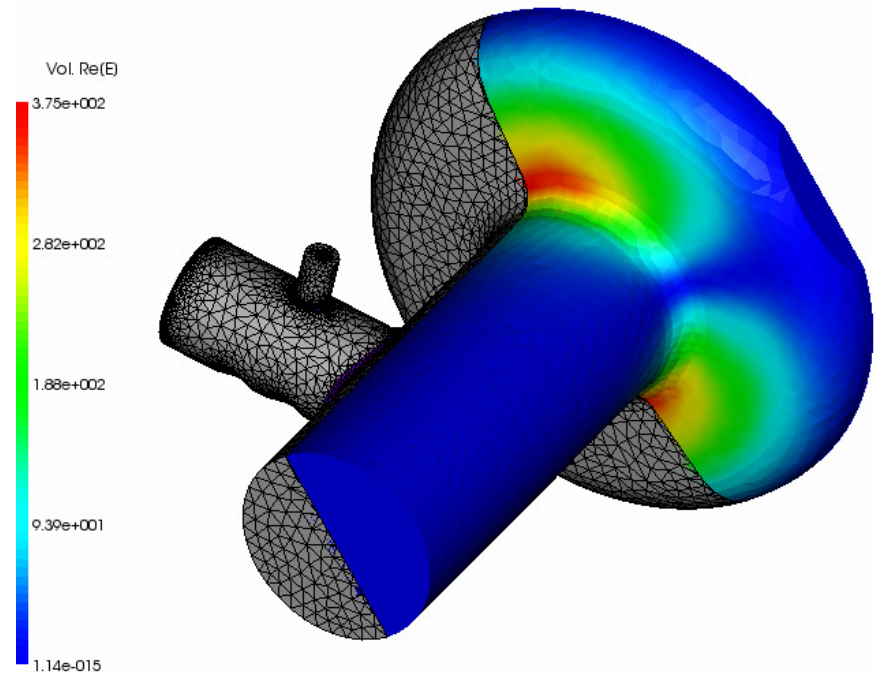


ECF shows the maximal MP activity at the field level about 28 MV/m.

EM fields in 2-post HOM Coupler



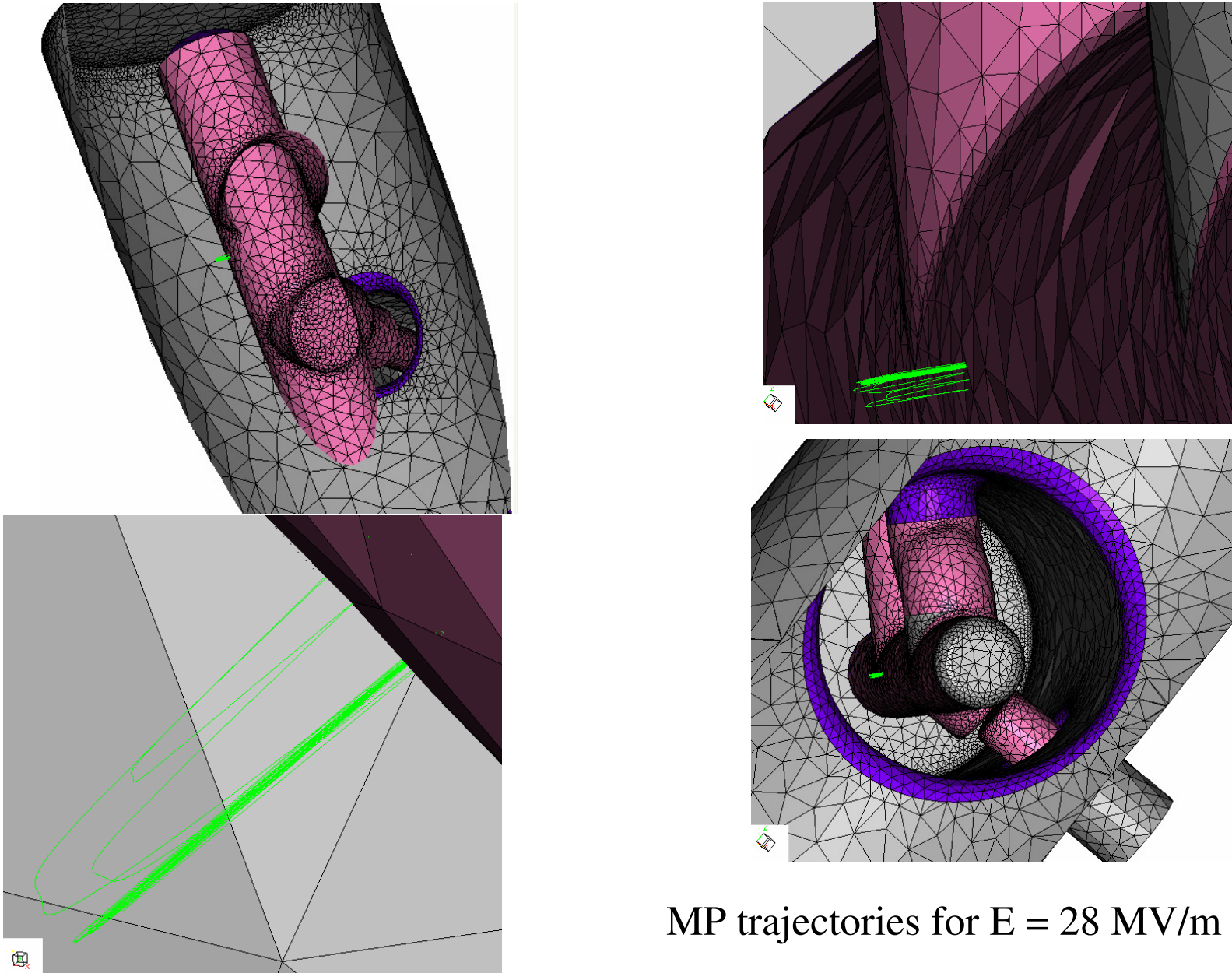
Electric field



Magnetic field

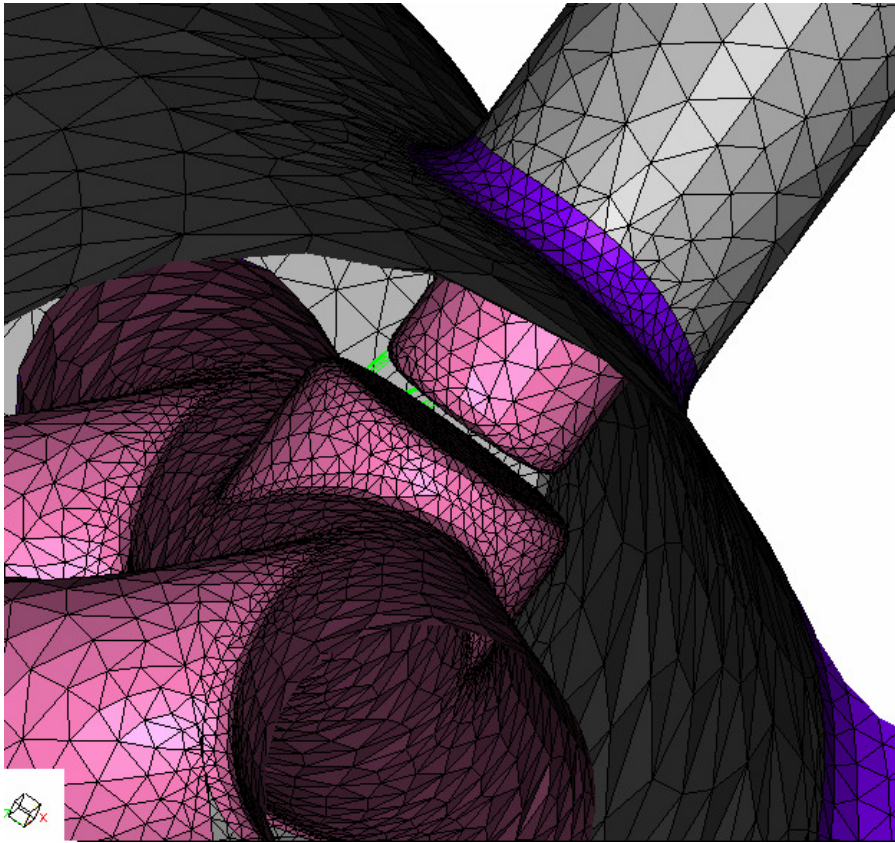
Tetrahedral mesh 38,422 nodes; 194,000 elements; 235,000 DOF.

MP phenomena in 2-post HOM Coupler

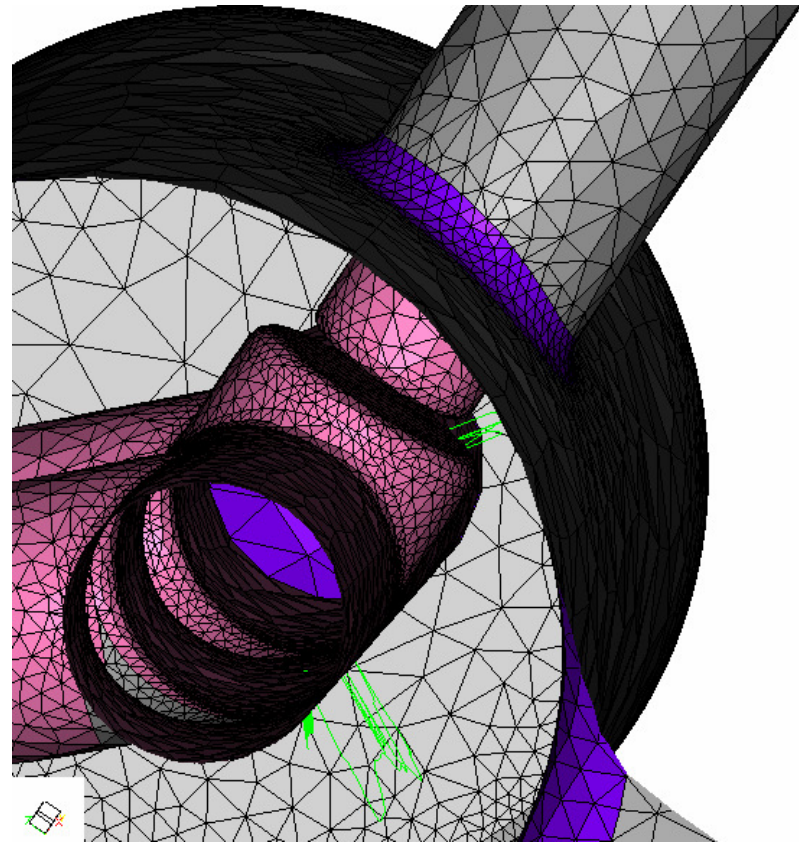


MP trajectories for $E = 28$ MV/m

MP phenomena in 2-post HOM Coupler

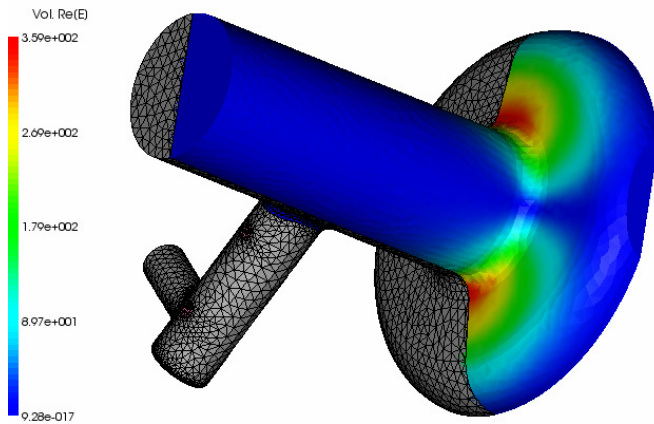


MP trajectories for $E = 24$ MV/m

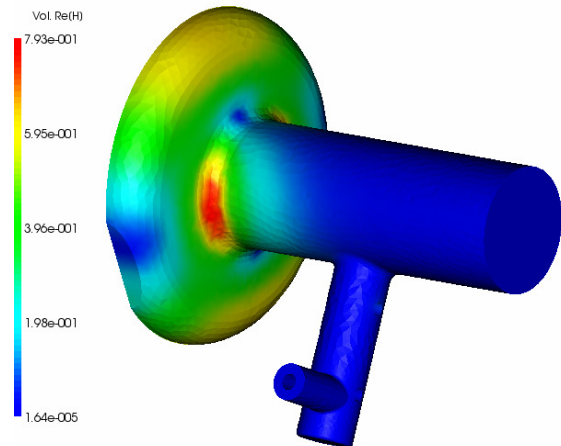


MP trajectories for $E = 30$ MV/m

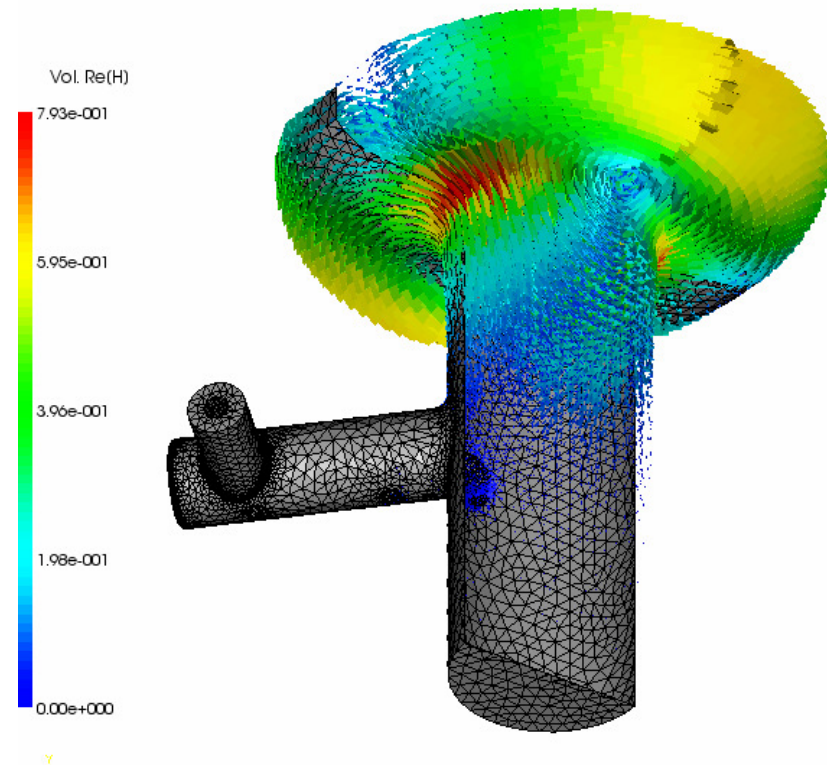
EM fields in LOM Coupler



Electric field

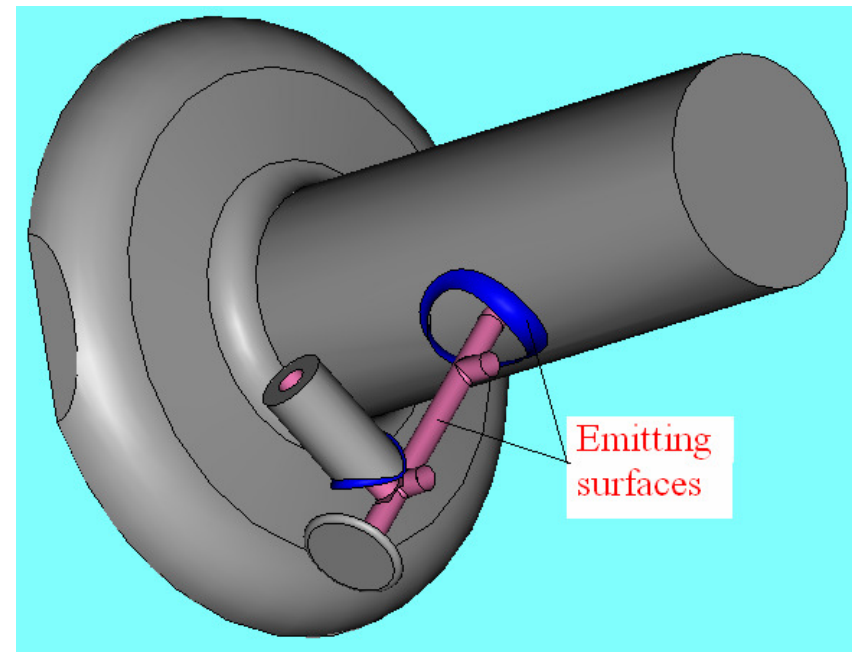
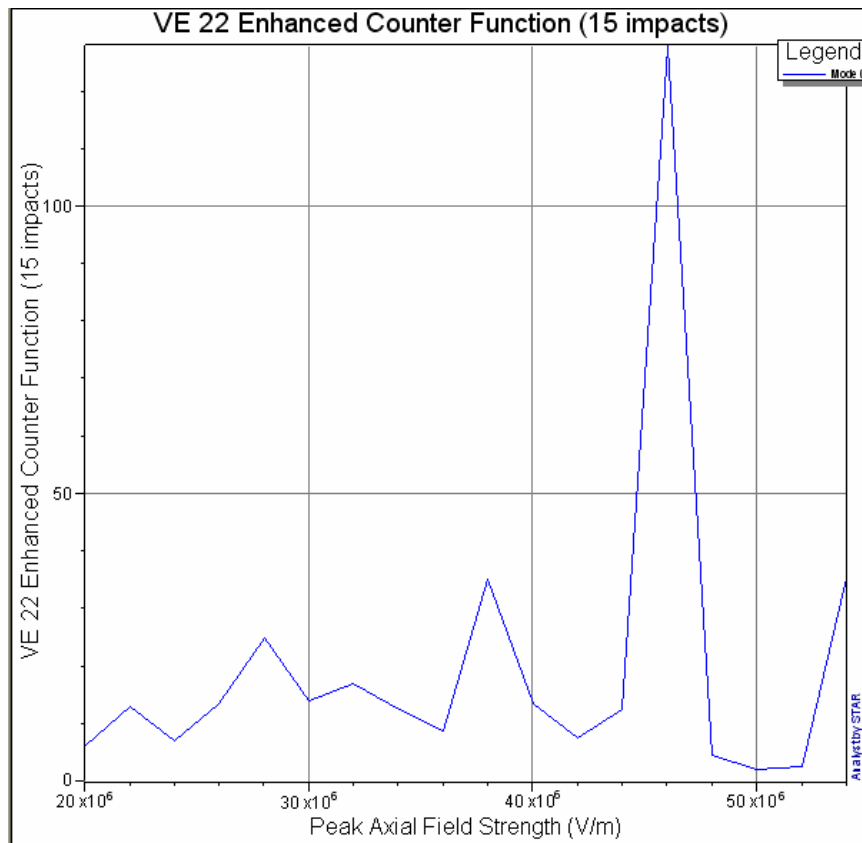


Magnetic field



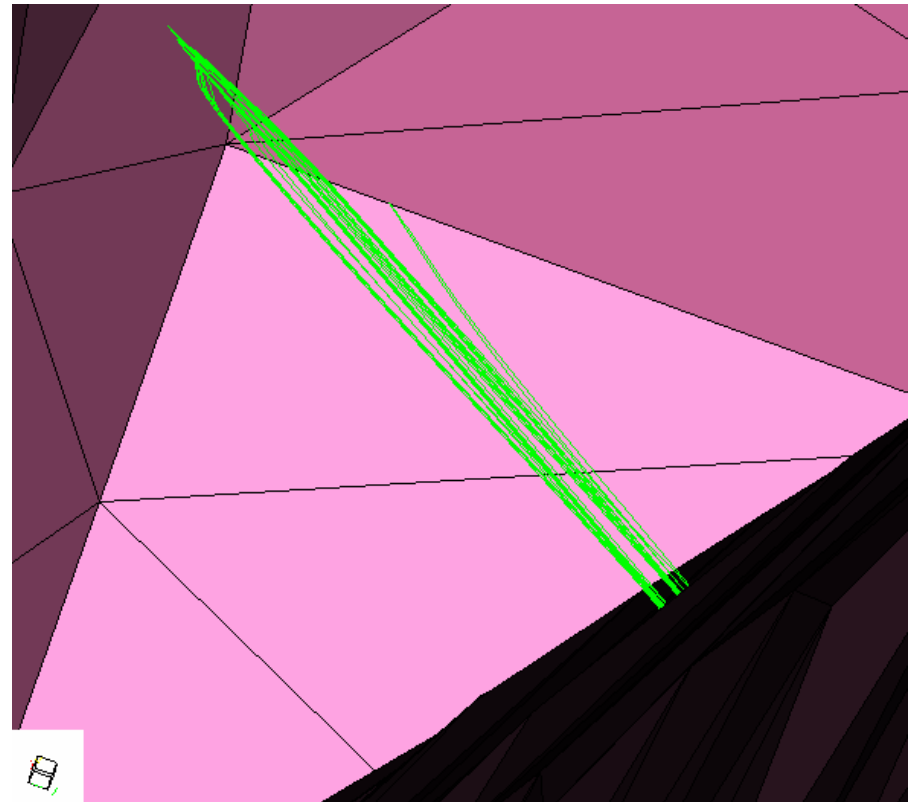
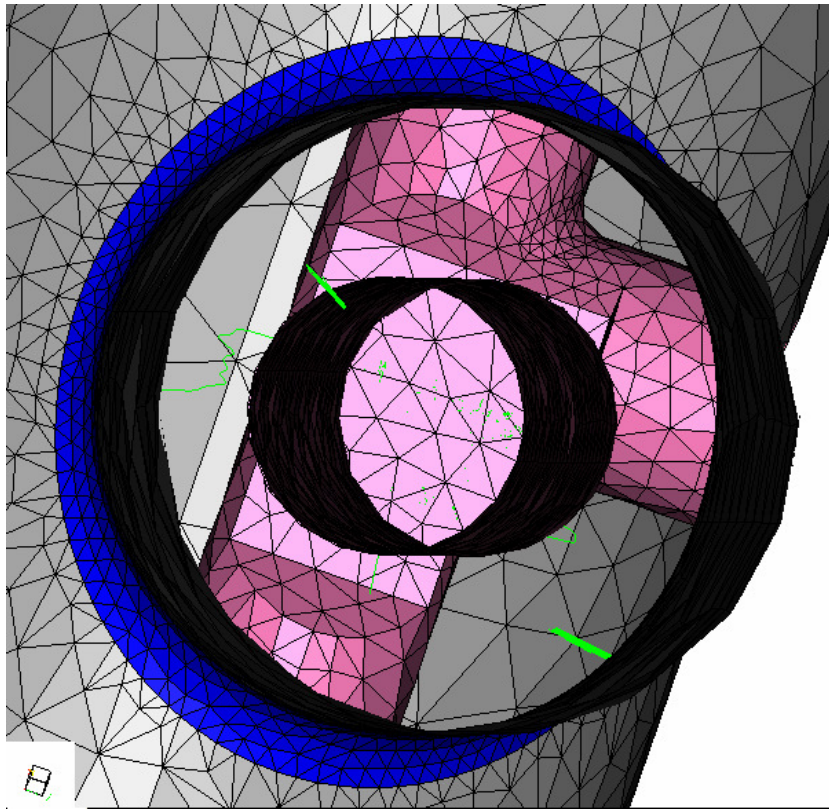
Tetrahedral mesh ~38,000 nodes.

MP phenomena in LOM Coupler

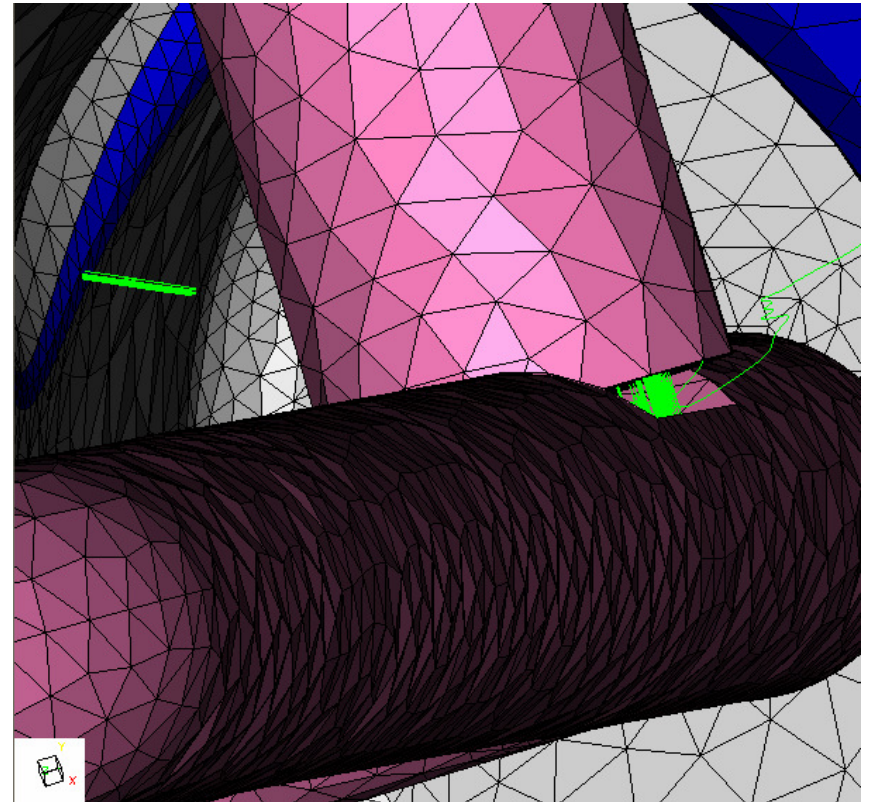
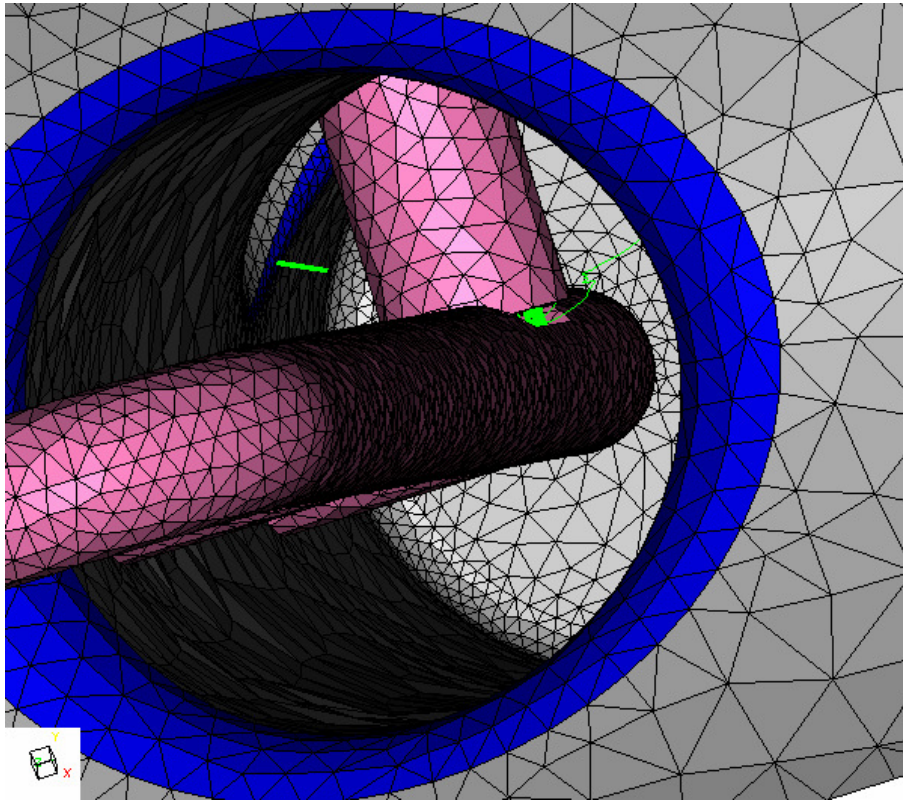


Maximal value for ECF corresponds to the field level about 36 MV/m

MP in LOM Coupler at 46 MV/m



MP in LOM Coupler at 46 MV/m



Acknowledgements

Special thanks to my colleagues :

- **Ivan Gonin** – for the help in familiarization of the Analyst numerical simulation tool;
- **Timergali Khabibulin** – for the geometry design for HOM & LOM couplers.

Summary:

- Analyst is a powerful tool for MP phenomena simulation for complex realistic rf devices in 3D;
- MP effects were founded and studied in LOM and HOM couplers for the Crab cavity;
- Our experience in using the Analyst tool allows us to formulate the requirements to improve the efficiency and post-processing features of the tool.